

Peer-reviewed Publications by ORD Investigators on Perfluorooctane Sulfonate (PFOS), Perfluorooctanoate (PFOA) and 2,3,3,3-Tetrafluoro-2-(Heptafluoropropoxy)-Propanoate (GenX) Toxicity

1. Hu, W., Jones, P.D., Upham, B.L., Trosko, J.E., Lau, C. and Giesy, J.P. (2002) Inhibition of gap junctional intercellular communication by perfluorinated compounds in rat liver and dolphin kidney epithelial cell lines in vitro and Sprague-Dawley rats in vivo. *Toxicol. Sci.*, 68:429-436.
2. Thibodeaux, J. R., Hanson, R.G., Rogers, J.M., Grey, B.E., Barbee, B.D., Richards, J.H., Butenhoff, J.L., Stevens, L.A. and Lau, C. (2003) Exposure to perfluorooctane sulfonate during pregnancy in rat and mouse. I. Maternal and prenatal evaluations. *Toxicol. Sci.*, 74:369-381.
3. Lau, C., Thibodeaux, J.R., Hanson, R.G., Rogers, J.M., Grey, B.E., Stanton, M.E., Butenhoff, J.L. and Stevenson, L.A. (2003) Exposure to perfluorooctane sulfonate during pregnancy in rat and mouse. II. Postnatal evaluation. *Toxicol. Sci.*, 74:382-392.
4. Grasty, R.C., Grey, B.E., Lau, C. and Rogers, J.M. (2004) Prenatal window of susceptibility to perfluorooctane sulfonate-induced neonatal mortality in the Sprague-Dawley rat. *Birth Defects Res. (Part B)*, 68:465-471.
5. Ankley, G.T., Kuehl, D.W., Kahl, M.D., Jensen, K.M., Butterworth, B.C. and Nichols, J.W. (2004) Partial life-cycle toxicity and bioconcentration modeling of perfluorooctanesulfonate in the northern leopard frog (*Rana pipiens*). *Environ. Toxicol. Chem.*, 23:2745-55.
6. Grasty, R.C., Bjork, J., Wallace, K. Lau, C. and Rogers, J.M. (2005) Effects of prenatal perfluorooctane sulfonate (PFOS) exposure on lung maturation in the perinatal rat. *Birth Defects Res. (Part B)*, 74:405-416.
7. Ankley, G.T., Kuehl, D.W., Kahl, M.D., Jensen, K.M., Linnum, A., Leino, R.L. and Villenuevet, D.A. (2005) Reproductive and developmental toxicity and bioconcentration of perfluorooctanesulfonate in a partial life-cycle test with the fathead minnow (*Pimephales promelas*). *Environ. Toxicol. Chem.*, 24:2316-24.
8. Lau, C., Thibodeaux, J.R., Hanson, R.G., Narotsky, M.G., Rogers, J.M., Lindstrom, A.B. and Strynar, M.J. (2006) Effects of perfluorooctanoic acid exposure during pregnancy in the mouse. *Toxicol. Sci.*, 90:510-518.
9. Takacs, M.L., and Abbott, B.D. (2007) Activation of mouse and human peroxisome proliferator-activated receptor ($\alpha, \beta/\delta, \gamma$) by perfluorooctanoic acid and perfluorooctane sulfonate. *Toxicol. Sci.*, 95:108-117.

10. White, S.S., Calafat, A.M., Kuklenyik, Z., Villanueva, L., Zehr, R.D., Helfant, L., Strynar, M.J., Lindstrom, A.B., Thibodeaux, J.R., Wood, C., and Fenton, S.E. (2007) Gestational PFOA exposure of mice is associated with altered mammary gland development in dams and female offspring. *Toxicol. Sci.*, 96:133-144.
11. Wolf, C.J., Fenton, S.E., Schmid, J.E., Calafat, A.M., Kulenyik, Z., Bryant, X.A., Thibodeaux, J., Das, K., White, S. S., Lau, C.S. and Abbott, B.D. (2007) Developmental toxicity of perfluorooctanoic acid (PFOA) after cross foster and restricted gestational exposure. *Toxicol. Sci.*, 95:462-473.
12. Martin, M.T., Breman, R., Hu, W., Ayanoglu, E., Lau, C., Ren, H. Wood, C.R., Corton, J.C., Kavlock, R.J. and Dix, D.J. (2007) Toxicogenomic study of triazole fungicides and perfluoroalkyl acids in rat livers accurately categorizes chemicals and identifies mechanisms of toxicity. *Toxicol. Sci.*, 97:595-613.
13. Chang, S., Thibodeaux, J.R., Eastvold, M.L., Ehresman, D.J., Bjork, J., Froehlich, J.W., Lau, C., Singh, R.J., Wallace, K.B. and Butenhoff, J.L. (2007) Negative bias from analog methods used in the analysis of free thyroid hormones in rat serum containing perfluorooctanesulfonate (PFOS). *Toxicology*, 234:21-33.
14. Abbott, B.D., Wolf, C.J., Schmid, J.E., Das, K., Zehr, R.D., Helfant, L., Nakayama, S., Lindstrom A.B., Strynar, M.J. and Lau, C. (2007) Perfluorooctanoic acid (PFOA)-induced developmental toxicity in the mouse is dependent on expression of peroxisome proliferator activated receptor-alpha (PPAR α). *Toxicol. Sci.*, 98:571-581.
15. Rosen, M.B., Thibodeaux, J.R., Wood, C.R., Zehr, R.D., Schmid, J.E. and Lau, C. (2007) Gene expression profiling in the lung and liver of PFOA-exposed mouse fetuses. *Toxicology*, 239:15-33.
16. Chang, S., Thibodeaux, J.R., Eastvold, M.L., Ehresman, D.J., Bjork, J.A., Froehlich, J.W., Lau, C., Singh, R.J., Wallace, K.B. and Butenhoff, J.L. (2008) Thyroid hormone status and pituitary function in adult rats given oral doses of perfluorooctanesulfonate (PFOS). *Toxicology*, 243:330-339.
17. Dewitt, J.C., Copeland, C.B., Strynar, M.J. and Luebke, R.W. (2008) Perfluorooctanoic acid-induced immunomodulation in adult C57BL/6J or C57BL/6N female mice. *Environ. Health Perspect.*, 116:644-650.
18. Wolf, D.C., Moore, T., Abbott, B.D., Rosen, M.B., Das, K.P., Zehr, R.D., Lindstrom, A.B., Strynar, M.J. and Lau, C. (2008) Comparative hepatic effects of perfluorooctanoic acid and WY 14,643 in PPAR α -knocked out and wild-type mice. *Toxicol. Pathol.*, 36:632-639.
19. Rosen, M.B., Abbott, B.D., Wolf, D.C., Corton, J.C., Schmid, J.R., Das, K.P., Zehr, R.D., Blair, E.T. and Lau, C. (2008) Gene profiling in the livers of wild-type and

- PPAR α -null mice exposed to perfluorooctanoic acid (PFOA). *Toxicol. Pathol.*, 36:592-607.
20. Rosen, M.B., Lee, J.S., Ren, H., Vallanat, B., Liu, J., Waalkes, M.P., Abbott, B.D., Lau, C. and Corton, J.C. (2008) Toxicogenomic dissection of the perfluorooctanoic acid transcript profile in mouse liver: Evidence for the involvement of nuclear receptors PPAR α and CAR. *Toxicol. Sci.*, 103:46-56.
 21. Chang, S., Das, K.P., Ehresman, D.J., Ellefson, M.E., Gorman, G.S., Hart, J.A., Noker, P.E., Tan, Y.-M., Lieder, P.H., Lau, C., Olsen, G.W. and Butenhoff, J.L. (2008) Comparative pharmacokinetics of perfluorobutyrate (PFBA) in rats, mice, and monkeys and humans and relevance to human exposure via drinking water. *Toxicol. Sci.*, 104:40-53.
 22. Das, K.P., Grey, B.E., Zehr, R.D., Wood, C., Butenhoff, J.L., Chang, S.-C., Ehresman, D.J., Tan, Y.-M. and Lau, C. (2008) Effects of perfluorobutyric acid exposure during pregnancy in the mouse. *Toxicol. Sci.*, 105:173-181.
 23. Bjork, J.A., Lau, C., Chang, S., Butenhoff, J.L. and Wallace, K.B. (2008) Perfluorooctane sulfonate-induced changes in neonatal rat liver gene expression. *Toxicology*, 251:8-20.
 24. Wolf, C.J., Takacs, M.R., Schmid J.E., Lau, C. and Abbott, B.D. (2008) Activation of mouse and human peroxisome proliferator-activated receptor alpha by perfluoroalkyl acids of different functional groups and chain lengths. *Toxicol. Sci.*, 106:162-171.
 25. Harris, L.A. and Barton, H.A. (2008) Comparing single and repeated dosimetry data for perfluorooctane sulfonate in rats. *Toxicol. Lett.*, 181:148-156.
 26. Wambaugh, J.F., Barton, H.A. and Setzer, R.W. (2008) Comparing models for perfluorooctanoic acid pharmacokinetics using Bayesian analysis. *J. Pharmacokinet. Pharmacodyn.*, 35:683-712.
 27. Lou, I., Wambaugh, J., Lau, C., Hanson, R.G., Lindstrom, A.B., Strynar, M.J., Zehr, R.D., Setzer, R.W. and Barton, H.A. (2009) Modeling single and repeated dose pharmacokinetics of PFOA in mice. *Toxicol. Sci.*, 107:331-341.
 28. DeWitt, J.C., Shnyra, A., Badr, M.Z., Loveless, S.E., Hoban, D., Frame, S.R., Cunard, R., Anderson, S.E., Meade, B.J., Pedan-Adams, M., Luebke, R.W. and Luster, M.I. (2009) Immunotoxicity of perfluorooctanoic acid and perfluorooctane sulfonate and the role of peroxisome proliferator-activated receptor alpha. *Crit. Rev. Toxicol.*, 39:76-94.
 29. Abbott, B.D., Wolf, C.J., Das, K.P., Zehr, R.D., Schmid, J.E., Lindstrom, A.B., Strynar, M.J. and Lau, C. (2009) Developmental toxicity of perfluorooctane

- sulfonate (PFOS) is not dependent on expression of peroxisome proliferator activated receptor-alpha (PPAR α) in the mouse. *Reprod. Toxicol.*, 27:258-265.
30. White, S.S., Kato, K., Jia, L.T., Basden, B.J., Calafat, A.M., Hines, E.P., Stanko, J.P., Wolf, C.J., Abbott, B.D. and Fenton, S.E. (2009) Effects of perfluorooctanoic acid on mouse mammary gland development and differentiation resulting from cross-foster and restricted gestational exposures. *Reprod. Toxicol.*, 27:289-298.
 31. Rosen, M.B., Schmid, J.E., Das, K.P., Wood, C.R., Zehr, R.D. and Lau, C. (2009) Gene expression profiling in the liver and lung of perfluorooctane sulfonate-exposed mouse fetuses: Comparison to changes induced by exposure to perfluorooctanoic acid. *Reprod. Toxicol.*, 27:278-288.
 32. Ren, H., Vallanat, B., Nelson, D.M., Yeung, L.W., Guruge, K.S., Lan, P.K., Lehman-McKeeman, D. and Corton, J.C. (2009) Evidence for the involvement of xenobiotic-responsive nuclear receptors in transcriptional effects upon perfluoroalkyl acid exposure in diverse species. *Reprod. Toxicol.*, 27:266-277.
 33. Rodriguez, C.E., Setzer, R.W. and Barton, H.A. (2009) Pharmacokinetic modeling of perfluorooctanoic acid during gestation and lactation in the mouse. *Reprod. Toxicol.*, 27:373-386.
 34. Hines, E.P., White, S.S., Stanko, J.P., Gibbs-Flournoy, E.A., Lau, C. and Fenton, S.E. (2009) Phenotypic dichotomy following developmental exposure to perfluorooctanoic acid (PFOA) in female CD-1 mice: Low doses induce elevated serum leptin and insulin, and overweight in mid-life. *Mol. Cell. Endocrinol.*, 304: 97-105.
 35. Peden-Adams, M.M., Stuckey, J.E., Gaworecki, K.M., Berger-Ritchie, J., Bryant, K., Jodice, P.G., Scott, T.R., Ferrario, J.B., Guan, B., Vigo, C., Boone, J.S., McGuinn, W.D., DeWitt, J.C. and Keil, D.E. (2009) Developmental toxicity in white leghorn chickens following in ovo exposure to perfluorooctane sulfonate (PFOS). *Reprod. Toxicol.*, 27:307-318.
 36. DeWitt, J.C., Copeland, C.B. and Luebke, R.W. (2009) Suppression of humoral immunity by perfluorooctanoic acid is independent of elevated serum corticosterone concentration in mice. *Toxicol. Sci.*, 109:106-112.
 37. Abbott, B.D., Wood, C.R., Watkins, A.M., Das, K.P. and Lau, C. (2010) Peroxisome proliferator activated Receptors alpha (PPAR α), beta (PPAR β), and gamma (PPAR γ) mRNA and protein expression in human fetal tissues. *PPAR Research*, Volume 2010, Article ID 690907, 19 pages doi:10.1155/2010/690907.

38. Hu, Q., Strynar, M.J. and DeWitt, J.C. (2010) Are developmentally exposed C57BL/6 mice insensitive to suppression of TDAR by PFOA? *J. Immunotoxicol.* 7:344-349.
39. Ren, H., Vallanat, B., Brown-Borg, H.M., Currie, R. and Corton, J.C. (2010) Regulation of Proteome Maintenance Gene Expression by Activators of Peroxisome Proliferator-Activated Receptor alpha (PPAR α)? *PPAR Res.* 2010:727194.
40. Rosen, M.B., Schmid, J.R., Zehr, R.D., Das, K.P., Abbott, B.D. and Lau, C. (2010) Gene expression profiling in wild-type and PPAR α -null mice exposed to perfluorooctane sulfonate reveals PPAR α -independent effects. *PPAR Research*, i Volume 2010, Article ID 794739, 23 pages, doi:10.1155/2010/794739.
41. Wolf, C.J., Zehr, R.D., Schmid, J.E., Lau, C. and Abbott, B.D. (2010) Developmental effects of perfluorononanoic acid in the mouse are dependent on peroxisome proliferator-activated receptor-alpha. *PPAR Research*, Volume 2010, Article ID 282896, 11 pages, doi:10.1155/2010/282896.
42. Macon, M.B., Villanueva, L.R., Tatum-Gibbs, K., Zehr, R.D., Strynar, M.J., Stanko, J.P., White, S.S., Helfant, L. and Fenton, S.E. (2011) Prenatal perfluorooctanoic acid exposure in CD-1 mice: low dose developmental effects and internal dosimetry. *Toxicol. Sci.*, 122:134-145.
43. Tatum-Gibbs, K., Wambaugh, J., Das, K.P., Zehr, R.D., Strynar, M.J., Lindstrom, A.B., Delinsky, A. and Lau, C. (2011) Comparative pharmacokinetics of perfluorononanoic acid in rat and mouse. *Toxicology*, 281:48-55.
44. White, S.S., Fenton, S.E. and Hines, E.P. (2011) Endocrine Disrupting Properties of Perfluorooctanoic Acid. *J. Steroid Biochem. Mol. Biol.*, 127:16-26.
45. White, S.S., Stanko, J.P., Kato, K., Calafat, A.M., Hines, E.P. and Fenton, S.E. (2011) Gestational and chronic low-dose PFOA exposures and mammary gland growth and differentiation in three generations of CD-1 mice. *Environ. Health Perspect.*, 119:1070-76.
46. Abbott, B.D., Wood, C.R., Watkins, A.M., Tatum-Gibbs, K., Das, K.P. and Lau, C. (2012) Effects of perfluorooctanoic acid (PFOA) on expression of peroxisome proliferator-activated receptors (PPAR) and nuclear receptor-regulated genes in fetal and postnatal CD-1 mouse tissues. *Reprod. Toxicol.*, 33:491-505.
47. Butenhoff, J.L., Bjork, J.A., Chang, S.C., Ehresman, D.J., Parker, G.A., Das, K., Lau, C., Lieder, P.H., van Otterdijk, F.M. and Wallace, K.B. (2012) Toxicological evaluation of ammonium perfluorobutyrate in rats: twenty-eight-day and ninety-day oral gavage studies. *Reprod. Toxicol.*, 33:513-530.

48. Hazelton, P.D., Cope, W.G., Pandolfo, T.J., Mosher, S., Strynar, M.J., Barnhart, M.C. and Bringolf, R.B. (2012) Partial life-cycle and acute toxicity of perfluoroalkyl acids to freshwater mussels. Environ. Toxicol. Chem., 31:1611-20.
49. Jiang, Q., Lust, R.M., Strynar, M.J., Dagnino, S. and DeWitt, J.C. (2012) Perflurooctanoic acid induces developmental cardiotoxicity in chicken embryos and hatchlings. Toxicology, 293:97-106.
50. Zhao, Y., Tan, Y.S., Strynar, M.J., Perez, G., Haslam, S.Z. and Yang, C. (2012) Perfluoroctanoic acid effects on ovaries mediate its inhibition of peripubertal mammary gland development in Balb/c and C57Bl/6 mice. Reprod. Toxicol., 33:563-576.
51. Dixon D, Reed CE, Moore AB, Gibbs-Flournoy EA, Hines EP, Wallace EA, Stanko JP, Lu Y, Jefferson WN, Newbold RR, Fenton SE. (2012) Histopathologic changes in the uterus, cervix and vagina of immature CD-1 mice exposed to low doses of perfluoroctanoic acid (PFOA) in a uterotrophic assay. Reprod Toxicol., 33:506-512.
52. Rosen, M.B., Das, K.P., Wood, C.R., Wolf, C.J., Abbott, B.D. and Lau, C. (2013) Evaluation of perfluoroalkyl acid activity using primary mouse and human hepatocytes. Toxicology, 308:129-137.
53. Carr, C.K., Watkins, A.M., Wolf, C.J., Abbott, B.D., Lau, C. and Gennings, C. (2013) Testing for departures from additivity in mixtures of perfluoroalkyl acids (PFAAs). Toxicology, 306:169-175.
54. Wambaugh, J.F., Setzer, R.W., Pitruzzello, A.M., Liu, J., Reif, D.M., Kleinstreuer, N.C., Wang, N.C., Sipes, N., Martin, M., Das, K., DeWitt, J.C., Strynar, M., Judson, R., Houck, K.A. and Lau, C. (2013) Dosimetric anchoring of in vivo and in vitro studies for perfluoroctanoate and perfluorooctanesulfonate. Toxicol. Sci., 136:308-327.
55. Rogers, J.M., Ellis-Hutchings, R.G., Grey, B.E., Zucker, R.M., Norwood, J. Jr., Grace, C.E., Gordon, C.J. and Lau, C. (2014) Elevated blood pressure in offspring of rats exposed to diverse chemicals during pregnancy. Toxicol. Sci., 137:436-446.
56. Wolf, C.J., Rider, C.V., Lau, C. and Abbott, B.D. (2014) Evaluating the additivity of perfluoroalkyl acids in binary combinations on peroxisome proliferator-activated receptor- α activation. Toxicology, 316:43-54.
57. Consoer D., Hoffman A.D. and Nichols J.W. (2014) Toxicokinetics of perfluoroctanoate (PFOA) in rainbow trout (*Oncorhynchus mykiss*). Aquatic Toxicology, 156:65-73.

58. Das, K.P., Grey, B.E., Rosen, M.B., Wood, C.R., Tatum-Gibbs, K.R., Zehr, R.D., Strynar, M.J., Lindstrom, A.B. and Lau, C. (2015) Developmental toxicity of perfluorononanoic acid in mice. *Reprod. Toxicol.*, 51:133-144.
59. Oshida, K., Vasani, N., Thomas, R.S., Applegate, D., Rosen, M., Abbott, B., Lau, C., Guo, G., Aleksunes, L.M., Klaassen, C. and Corton, J.C. (2015) Identification of modulators of the nuclear receptor peroxisome proliferator-activated receptor α (PPAR α) in a mouse liver gene expression compendium. *PLoS ONE* 10(2): e0112655. doi:10.1371/journal.pone.0112655.
60. Watkins, A.M., Wood, C.R., Lin, M.T. and Abbott, B.D. (2015) The effects of perfluorinated chemicals on adipocyte differentiation in vitro. *Mol. Cell. Endocrinol.*, 400:90-101.
61. Tucker, D.K., Macon, M.B., Strynar, M.J., Dagnino, S., Andersen, E. and Fenton, S.E. (2015) The mammary gland is a sensitive pubertal target in CD-1 and C57Bl/6 mice following perinatal perfluorooctanoic acid (PFOA) exposure. *Reprod. Toxicol.*, 54:26-36.
62. DeWitt, J.C., Williams, W.C., Creech, N.J. and Luebke, R.W. (2016) Suppression of antigen-specific antibody responses in mice exposed to perfluorooctanoic acid: Role of PPAR α and T- and B-cell targeting. *J. Immunotoxicology*, 13:38-45.
63. Consoer, D., Hoffman, A.D., Fitzsimmons, P.N., Kosian, P.A. and Nichols, J.W. (2016) Toxicokinetics of perfluorooctane sulfonate (PFOS) in rainbow trout (*Oncorhynchus mykiss*). *Environ. Toxicol. Chem.*, 35:717-727.
64. Beggs, K.M., McGreal, S.R., McCarthy, A., Gunewardena, S., Lampe, J.N., Lau, C. and Apte, U. (2016) The role of hepatocyte nuclear factor 4-alpha in perfluorooctanoic acid- and perfluorooctanesulfonic acid-induced hepatocellular dysfunction. *Toxicol. and Appl. Pharmacol.*, 304:18-29.
65. Dagnino, S., Strynar, M.J., McMahan, R.L., Lau, C.S., Ball, C., Garantziosis, S., McClean, M. and Lindstrom, A.B. (2016) Identification of Biomarkers of exposure to FTOHs and PAPs in Humans using a non-targeted analysis approach. *Environ. Sci. Technol.*, 50:10216-10225.
66. Rushing, B.R., Hu, Q., Franklin, J.N., McMahan, R., Dagnino, S., Higgins, C.P., Strynar, M.J. and DeWitt, J.C. (2017) Evaluation of the immunomodulatory effects of 2,3,3,3-Tetrafluoro-2-(Heptafluoropropoxy)-Propanoate in C57BL/6 mice. *Toxicol. Sci.*, 156:179-189.
67. Das, K.P., Wood, C.R., Lin, M.T., Starkov, A.A., Lau, C., Wallace, K.B., Corton, J.C. and Abbott, B.D. (2017) Perfluoroalkyl acids-induced liver steatosis: Effects on genes controlling lipid homeostasis. *Toxicology*, 378:37-52.

68. Crawford, N.M., Fenton, S.E., Strynar, M, Hines, E.P., Pritchard, D.A. and Steiner A.Z. (2017) Effects of perfluorinated chemicals on thyroid function, markers of ovarian reserve, and natural fertility. *Reprod. Toxicol.* 69:53-59.
69. Rosen, M.B., Das, K.P., Rooney, J., Abbott, B.A., Lau, C. and Corton, J.C. (2017) PPAR α -independent transcriptional targets of perfluoroalkyl acids revealed by transcript profiling. *Toxicology*, 387:95-107.